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PEGASUS

TO-DAY AND TO-MORROW

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of this Book*



GUY ONE-TON LORRY
Hauling a full load up a one-in-two gradient (notice the vertical stick hanging from string
from lamp bracket)

PEGASUS

PROBLEMS OF TRANSPORTATION

BY

COLONEL J. F. C. FULLER

WITH 8 PLATES

LONDON

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PREFACE

THE first part of this little book, namely "The Battle of the Iron Horse," appeared, very much as it stands, in the September number of *The National Review*, 1925, and I have to thank the editor, Mr. Leo Maxse, for his kindness in allowing me to republish it.

The second part is based partially on personal experience and reflection, and partially on the lectures and papers of others. In the war, the tank brought me to realize the enormous possibilities of cross-country movement, and, in 1921, I set down my ideas as regards its commercial future in a pamphlet entitled *Economic Movement*, which was published in 1922.

Of the works of others, I have borrowed ideas from the following:—

"Improvements in the Efficiency of Roadless Vehicles." A paper read before

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the members of The Institution of Automobile Engineers, by Colonel P. H. Johnson, C.B.E., D.S.O., December, 1921.

“ Multi-Wheel and Track Motor.” A paper read before the members of the above Institution by Major T. G. Tulloch, March, 1923.

“ The Progress of Mechanical Engineering in the Military Service.” A lecture delivered before the members of The Institution of Mechanical Engineers, by Major G. le Q. Martel, D.S.O., M.C., January, 1924.

“ Transport in Tropical Africa.” A paper read before the members of The Royal Society of Arts, by Mr. R. H. Brackenbury, February, 1925.

“ The Roadless Transport Problem.” A paper read before the members of The British Association, by Colonel P. H. Johnson, C.B.E., D.S.O., August, 1925.

Staff College, Camberley.
November, 1925.

J.F.C.F.

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PROBLEMS OF TRANSPORTATION

INTRODUCTION

WHATEVER man does entails movement, mental or bodily. Movement is, in fact, the mainspring of his evolution and of the civilization which this evolution engenders; consequently, in the economic growth of movement must be sought the direction of all progress, both physical and psychological. As the mind of man moves, so does the world, in which this mind works, move round him, delivering up to his imagination and his hands the mysteries it so sedulously hides. For it is through the conquest of mysteries that man, the mystery of mysteries, strides out of a dark and unknown past towards some unknown future.

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It would be both logical and easy, I think, to start with the soles of man's feet and to work upwards to his brain. To show how, from simple walking, man's natural means of progression, he took to riding, and then thought of the oar, the wheel and the sail, until to-day he rushes over the surface of the earth, surges through the waves and roars through the air, excelling the horse, the fish and the bird. But in so small a book as this it is not my intention to write a history of transportation. In place, I intend to consider two things: first, the reaction against novelty of movement, and secondly, the possibilities of what to-day is still a novel form of movement, namely, the movement of roadless vehicles, that is of vehicles which do not require roads for their locomotion. Also, I intend to show how these vehicles may help us solve several of our most pressing problems, and above all that of over-population at home and under-population in our Dominions and Colonies.

INTRODUCTION

If I can do this with any semblance of success, it may perhaps excuse the restrictions I am placing on this subject, for I fully realize the immense future possibilities of other means of movement. The railway has not come to the end of its evolution, far from it to any reader of Mr. Horniman's book, "How to Make the Railways Pay for the War," in which Mr. Gattie's "third-dimensional" railway system is described, a system which bids fair, were it introduced, to prove as revolutionary as George Stephenson's locomotive itself. Nor has the steamship, except perhaps in size, reached its utmost development, for every day heralds a further improvement, and, as for aircraft, they are scarcely out of the nursery; yet I am of opinion that, until a radical change in their engines is introduced, and this change may demand a new motive force, their utility in peace will be severely restricted, and, if restricted in peace, in numbers they are not likely to be so numerous in war as

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some people imagine. I mention these things here because of the limit I have placed on the items I intend to examine when compared to the subject of economic movement as a whole.

I have called this little book Pegasus, not only because this famous steed had wings, which to me are the wings of imagination, but because he was born near the sources of the ocean and sprang from the blood of Medusa. To me, the sources of the ocean are symbolic of these little islands of ours, which produced not only the first practical steam engine and the first locomotive, but also the footed wheel which developed into the caterpillar track. Further, Medusa, that monster who turned all who gazed on her to stone, is surely the incarnation of that obstructive ignorance which, by impeding originality of idea and novelty of action, compels thought and things to grow, and through struggle with her to prove their utility and worth.

THE BATTLE OF THE IRON HORSE

THE RAILWAY CENTENARY

I MUST begin somewhere, and since I refuse to begin at the soles of men's feet, which are the beginning of his anatomy, the earth is our natural datum point, I will begin just a hundred years ago, when the world we know to-day was as remote from the world as it was then, as the world I hope to point the way to will, in many ways, be as remote from the world as it is now.

On the 27th of September, of this very year in which I write, took place the centenary of the opening of the Stockton and Darlington railway, and though it was not the first line to be constructed in England (for the Killingworth railway was built in 1814, and again this was not the first upon which locomotives ran),

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its claim to priority is nevertheless well founded, for it was the first railway the public noticed, and, in democratic countries, the birth of anything original must date from the moment the most ignorant in the land realize its existence. It flatters ignorance to be always first—such is democratic pride.

The 27th of September, 1825, was a very remarkable day in the world's history, one of those birthdays which have no predictable date, but which depend on the outburst of genius of some great man. The great man was a humble and self-taught engine-wright from Killingworth, one George Stephenson, albeit an honest and persevering man, a worker, a thinker and a dreamer; one of those human thunder clouds which, from time to time, beat up against the conventional currents of thought, and out of which flash the lightnings of unsuspected things—a very remarkable and creative man.

On the 27th of September, a hundred years ago, a great concourse of people

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assembled at Brusselton Incline, some nine miles from Darlington. There, the travelling engine, as it was called, driven by George Stephenson, the greatest genius of his age, moved forward amidst shrill blasts of its whistle, "with its immense train of carriages," thirty-eight in number; "and such was its velocity," writes an eye-witness, "that in some parts the speed was frequently twelve miles an hour!" It took sixty-five minutes to cover the nine miles to Darlington, and the multitude stood aghast!

But the other day, I travelled in the "Detrouiter" from New York to near by the front door of Mr. Henry Ford—another remarkable and self-taught revolutionary—the distance, if I remember rightly, some seven hundred and fifty miles, and the time taken was fourteen hours. From Brusselton Incline the iron horse hauled away, amidst wild excitement, the stupendous load of ninety tons. At Pittsburg, I have seen locomotives hauling six and seven

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thousand tons of coal, puffing by all unobserved. Surely Einstein is right, the relative is only true, and ninety tons in 1825 was almost as unbelievable as to-day would be a centaur galloping between the taxis of Piccadilly or Fifth Avenue.

All this must have been remembered during the centenary celebrations this year, and broadcast from meeting room, assembly hall and dinner table, for centenaries lose their interest without much feeding. There, little men in tail coats, morning jackets and lounge suits, some with trousers creased and others somewhat baggy at the knee, according to the political creed of the wearer, in port and beer, and, in America, I know not what, toasted the memory of the great man. Pæans and praise gushed from their arid heads like the water from the rock smitten by Moses. These little men, sitting for a bare few minutes on the chariot wheel of genius, did say, "What a dust do we raise!" And in our morn-

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ing papers we read of all this blather and pomposity, and overlooked an eternal truth. For we got into our railway carriages next day and complained of their unfitness for human habitation, even of ~~the~~ most temporary nature, and condemned the line we were travelling on as impossible, because the train was five minutes late. Outwardly a very ordinary picture, all this—the drinking, speech-making and travelling troubles of little men, some strap-hangers to genius, but most quite normal nonentities; yet behind it all lurks a somewhat interesting problem—the protean psychology of the very ordinary man.

THE PROTEAN PROBLEM

Since that famous Brusselton gathering, the noise of which has long deafened the world to the wonder of its sound, what changes do we see! A whole earth

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rejuvenated, as humanity, like a shuttle, works the woof of a new civilization through the warp of an old. Civilization is built on movement, and the picture of life to-day is as different from that of 1825, in rough proportion, as a cinema show differs from a neolithic rock painting. In this short hundred years, the life span of a very old man, such a revolution has been brought about by the locomotive that the world has been reborn. And, to our limited intelligence, always that of a child, we have forgotten the events of this first birthday; and the changes, which it conjured out of the depths of ignorance, are to-day accepted by us all as the essentials of our surroundings and as necessitous to our lives.

If some magician could appear to-day, and, by a wave of his wand, banish all railroads to limbo, a calamity would fall upon this world to which no parallel could be found since Noah entered the Ark. The greatest plagues, famines and wars would vanish like wisps of smoke into the

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night, when compared to its all-consuming horror. It would be like dragging out of the human body the arterial and venous systems, and yet leaving the man alive, an aching mass of bones and fiery nerves. The picture is indescribable, it is beyond the grasp of intelligence to grip it, and yet, in 1825, the ancestors, the grandfathers, and great grandfathers, and great grandmothers, too, of all the little men who in 1925 were dressed in dinner jackets (or tuxedo, as they call it over the Atlantic) morning coats and lounge suits, made to measure and "off the peg," were shouting down George Stephenson, even more boisterously than their grandsons and great grandsons this year shouted him up. This, then is the protean problem, that eternal truth overlooked as we read in our newspapers that a workman has been killed in Walworth or a girl has deposited a baby outside an A.B.C. in the Strand, and so on, *ad infinitum*, the long categories of the normalities of life. This is the inner problem George

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Stephenson has to teach us, and let us consider it, for it is a live and moving problem, and one which will not be masticated by very ordinary men, as they gulp down their beer, their port or iced water. It is the problem of " 'Hail, king of the Jews,' one day and 'Crucify Him' the next." It is, as I say, the veritable protean problem of humanity, and nine hundred and ninety-nine human beings out of every thousand are very, very, ordinary men.

THE X-RAY TRANSPORTER

Let us picture to ourselves another magician descending on this earth of ours, a man of magic with the prosaic name of John Smith, yet none the less a man of genius, for all such are magicians in very fact. He is a very modern genius, and, I will suppose that he has discovered how to transform any and all physical things

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into ether waves moving at 186,000 miles a second, and that he can precipitate in its original form any article or being sent to any given spot; all this arrived at by tapping a key or pressing a button.

What a traffic problem is here opened to this world; so immense that it puts to blush the power of that horrid wizard who would remove our railways. Its conception is no more impossible than that of broadcasting. Even in so remote a village as Camberley (thirty miles distant from London, and there I write), where electrical genius is conspicuously absent, I can switch on to Paris and listen to Galli Curci or any other human bird. And what appears to me far more marvellous, simultaneously a fisherman in Trondhjem can do likewise. An immense audience in fact this Galli Curci can command, and totally unknown to her, totally unseen and out of contact even with itself, a dust of individuals, each speck of which can travel on or off her song by mere pressure of the hand, each speck of which

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can travel by ear at infinite speed and to any civilized point on the globe. If this is not magic, what is?

If song can be etherealized, why not then the singer? How much more remarkable would it not be, in place of scanning bold headlines of dead workmen and deposited babies, to read that Melba will sing in New York, at a quarter past three next Saturday afternoon, and at the Opera House in Paris, that very same day, and but twenty minutes later.

If we can transmit one thing, surely the day must soon come when we shall be able to transmit all things, and my genius John Smith is the man of that day. What could he not do? He could solve the traffic problem in Regent Street or Broadway, for all, astonished reader, you would have to do would be to sit on a transmitter, press a button, and in the minutest fraction of a second, you would find yourself in Peter Robinson's, or Mr. Morgan's office, or wherever you wanted to go, all for a penny or a couple of cents!

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He could banish the Communists to the moon, where there are no capitalists and where there is plenty of ice to keep their heads cool. He could replace the League of Nations by a row of chairs. The Grenadier Guards would fall in to the stentorian yells of their Sergeant-Major to be seated. The button would be pressed by the Army Council and, in less than a twinkle of an eye, they would be doing their famous goose-step down the Sieges Alle, to the utter consternation of the terrible Teuton.

Dear and crawling reader, what could he not do, and what could not you do? Half-a-crown, or half-a-dollar, would take you round the world—bag, baggage and all. And if you do not forget your purse, you can breakfast in New York at a cafeteria, lunch with Ongo-Pongo on the shores of Lake Chad, have tea in Yoshiwara, at the “Nectarine” for choice, and sup with Doris in the Bois de Boulogne at 8.30—this, indeed, is to live.

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But what would you do—you beefsteak-eating bull of a Briton, yes, what would you do? You would don your lounge suit or your morning coat, or your tuxedo, as your great grandfathers did right back in 1825. You would become thoroughly traditional and would say: "Why, this man is mad—a raving lunatic! Send me to Lake Chad? . . . Good God, man, what is he thinking about . . . Lock him up!"

Then the storm would burst. The leading engineers, "eminent" as they are called by every newspaper, would say it was contrary to etheric law; Harley Street would be thoroughly up in arms, for all their old lady friends might suddenly betake themselves in a second to Madeira and get cured of their ailments; the physicians would say the human frame cannot stand this rush; the bath-chairmen would say that their occupation was gone; the lawyers would say it was illegal and that it would lead to the Cocos Islands becoming a refuge for criminals; the

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soldiers would say, how could they be expected to protect this dash dashed land, why, it did not fit their strategy, therefore it *must* be wrong. And what would the clergy say? Heaven alone knows, for whilst antiquity and things antiquated separate the Churches, any novelty of a progressive nature is apt to bring them together with amazing unanimity.

The reader may be beginning to think that I, the writer, am off my head, but I am not. So far, all I have done is to reveal protean possibilities, now I will turn to actualities of the same psychological order. I will imagine that this genius Mr. Smith has, in disgust, removed himself to Aldebaran, and that we are about to get back to the Brusselton Incline.

ERICHTHONIUS, WHEELWRIGHT

I must have missed the Incline in my haste to get back to Brusselton, for I find

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myself in Athens in the Minoan age, or thereabouts, for the year is 1486 B.C. Everyone seems very excited; porters have thrown down their baskets and are yelling unintelligible words, yet of a pronounced and universal meaning; shoemakers are beating at a house door with their lasts. Whatever is up? A dainty little creature, some now far away Doris, approaches me and says: "Do you know what that old blighter (my Attic is weak) has done? Why, he has invented a thing called a chariot, and all these poor people have lost their jobs."

Of course, Erichthonius never invented the chariot; the idea of a pure inventor is but a piece of proletarian imagery, a morsel of that ignorance which is the soul of the crowd. This old man, even if he ever lived, which seems doubtful, did no more than Savery did, or Newcomen, or Watt, or Stephenson, or Marconi did; that is, he was a link in that great chain we call progress, each link being the great thought of a great man. Tutenkhamon

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had his chariot as we well know, and many another before him, and we read in the Acts of the Apostles of a eunuch of great authority, a kind of Maître d'Hôtel of Candace, queen of the Ethiopians, journeying to Jerusalem sitting in his chariot reading Esaias, the prophet, which is no mean compliment to the Roman road-makers in Palestine.

I must, however, hasten back to Brusselton, for there lies my goal; but stop, what is this? "A whirlicote," a "Noah's Ark," or, in common language, an Elizabethan coach; for sure—a direct descendent of the handicraft of Erichthonius. The Earl of Rutland, it is said, first built whirlicotes in this country, in 1565, and, in spite of the villainous condition of the roads, my lords and ladies soon took to them. This, apparently, was a sure proof, in its day, that the country was going to the dogs; for, early in the seventeenth century, a bill was brought into Parliament "to prevent the effeminacy of men riding in

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coaches." Hitherto Englishmen had ridden or walked, why should they not continue to do so, why not, indeed?

In the first quarter of the seventeenth century, the number of coaches in London was reckoned at six thousand and odd,* and in a curious old book, published in 1636, and recently reprinted, called "Coach and Sedan," of these six thousand and odd whirlicotes we read:—

"I easilie (quoth I) beleeeve it, when in certaine places of the Citie, as I have often observed, I have never come but I have there, the way barricado'd up with a *Coach*, two, or three, that what hast, or businesse soever a man hath; hee must waite my Ladie (I know not whose) leasure (who is in the next shop, buying pendants for her eares; or a collar for her dogge) ere hee can find any passage."

It is Regent Street or Fifth Avenue over again, for, according to this author, when there is a new Masque at Whitehall, the coaches stand together "like mutton-pies in a cooke's oven," and then he adds:

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and “hardly you can thrust a pole between them!”

In its turn, the stage coach was opposed tooth and nail, because it was something new. In 1671, Sir Henry Herbert, M.P., stated that: “If a man were to propose to convey us regularly to Edinburgh in seven days, and bring us back in seven more, should we not vote him to Bedlam?” Sir Henry Herbert is what I call a psychological Proteus, a kind of intellectual amoeba which propagates itself by simple division, the parts of which are always with us and alike—they never die.

THE PHILOSOPHER'S STEAM

The Brusselton Incline is now in sight, so I will pause and look back whilst I regain breath. The horse of Troy was a very wonderful beast, and many strange things came out of it, for it was the

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strangest thing man had seen since the Ark. But years after Troy was burnt, a stranger thing was seen in Alexandria. It was called an aeolipile, a kind of rudimentary steam engine, which was invented by one, Hero, in 130 B.C. He used it to open and close the doors of a temple, yet it was eventually destined to open the portal of a new world, a glimpse of which would have sent Hero or Columbus completely out of their minds. Yet these greater doors remained closed for seventeen hundred years, when another, this time Battista della Porta, in the year 1601, re-discovered the power of steam.

In 1641, Marion de Lorme, accompanied by the Marquis of Worcester, visited the madhouse of the Bicêtre in Paris, and this is what he writes:—

“ We were crossing the court, and I, more dead than alive with fright, kept close to my companion’s side, when a frightful face appeared behind some immense bars, and a hoarse voice

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exclaimed, ' I am not mad ! I am not mad ! I have made a discovery that would enrich the country that adopted it.' ' What has he discovered ? ' asked our guide. ' Oh ! ' answered the keeper, shrugging his shoulders, ' Something trifling enough ; you would never guess it ; it is the use of the steam of boiling water. ' "

Who was this maniac ? It was Solomon de Caus, he had a vision whilst dabbling with steam vessels, and he had seen carriages and ships propelled by steam. This was too much for men dressed in half hose and doublets, or whatever was the tuxedo of their day. " Carriages driven by steam . . . lock him up ! " So he was locked up. But the idea lived on, and it grew. There was Giovanni Branca, Edward Somerset, Marquis of Worcester, then Thomas Savery, who, in 1698, obtained a patent for a water raising engine. There were others, Jean de Hautefeuille, who, in 1678, suggested the piston ; Denis Papin,

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1690, of cylinder and piston fame. At length Thomas Newcomen, 1705, something near success; others still, Humphrey Potter, Henry Beighton, but all waiting for *the* man. Then *the* man came in the form of a poor instrument maker, and the new Jerusalem of the steam age was Glasgow, for there did he work. This man was James Watt, who, having realized that the cylinder of an engine should always be as hot as the steam which entered it, in 1769 threw open the doors of the most stupendous epoch in economic history. The transmutation of heat into mechanical work had been discovered, it was the true stone of the philosophers, the "Open Sesame" to another age.

GEORGE STEPHENSON, ENGINE-WRIGHT

In the very year James Watt built the first practical steam engine, namely, the

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year 1769—the year Napoleon was born—fearful riots were taking place in Russia, because some enlightened person had introduced the potato, a useful vegetable as we all know, yet at this time one in which the Russian peasant saw the Satanic thumb, for he was certain that this humble vegetable was the “devil’s apple.” Though why this should have detracted from its nutritive qualities I cannot say.

Looking back now, and we are nearing Brusselton, it seems to me that there is no difference between the spirit of these deluded peasants and those who, with shoe lasts, beat vigorously on the door of Erichthonius’s house. They are one and all Sir Henry Herberts, though the particular cut of their clothes may differ. George Stephenson, having studied steam engines in general and Mr. Trevithick’s crude and inefficient locomotive in particular, determined to build one of his own, and, with the support of Lord Ravensworth, he accomplished this feat

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at Killingworth in 1814. There the first efficient locomotive was made. Had Lord Eldon been a Russian, he would probably have objected to potatoes, but being an Englishman he preferred bigger game. "I am sorry," he said, "to find the intelligent people of the North-country gone mad on the subject of railways." A few miles had only been opened, but this was quite sufficient to establish madness, and by some other of his ilk, the adage, "A fool and his money are soon parted," was applied to Lord Ravensworth.

The Killingworth railway was followed by the Stockton and Darlington line. Mr. Edward Pease, the Quaker supporter of Stephenson, had said: "Let the country but make the railroads, and the railroads will make the country." Be it remembered that locomotives had been working at Killingworth, and very efficiently, for ten years; but there were others who, unlike Mr. Pease, were full of the spirit of old Herbert. The Duke of Cleveland opposed the measure in Parliament, as the

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line would pass through his fox covers, and, due to his influence it was thrown out. A new survey was made, avoiding these precious earths, and the railway was built.

The next line was that between Manchester and Liverpool. Lord Derby turned out his farm hands to chase Stephenson's surveyors off his estates. Lord Sefton did likewise, and the Duke of Bridgewater threatened to shoot them at sight. Stephenson had his theodolite so often smashed that he deemed it wise to hire a prize fighter to carry it. The "Quarterly Review" supported the project, and it is curious to read what it said, for it will give the reader some idea of the virulence of the opposition. It says:

"What can be more palpably absurd and ridiculous than the prospect held out of locomotives travelling *twice as fast* as stage coaches! We should as soon expect the people of Woolwich to suffer themselves to be fired off upon one of

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Congreve's ricochet rockets, as trust themselves to the mercy of such a machine going at such a rate. . . . We trust that Parliament will, in all railways it may sanction, limit the speed to *eight or nine miles an hour*, which we entirely agree with Mr. Sylvester is as great as can be ventured on with safety."

This was praise indeed, and it is amazing that the British Parliament, which is always full of ordinary men, did not take the hint and limit the speed of the locomotive to that of a trotting horse. Nevertheless, though this grand opportunity was missed, the Parliamentary Committee did all in its power to obstruct the measure. One of its members asked George Stephenson: "Suppose a cow were to stray upon the line?" There was a hush of horror, then he added: "Would not that, think you, be a very awkward circumstance?" "Yes," answered Stephenson, "very awkward indeed—for the *coo*!"

The leading councils openly declared

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that this "untaught and inarticulate genius" was mad. . . . "Every part of the scheme shows that this man has applied himself to a subject of which he has no knowledge, and to which he has no science to apply." Not only would these locomotive engines be a terrible nuisance, "in consequence of the fire and smoke vomited forth by them," but "the value of land in the neighbourhood of Manchester alone would be deteriorated by no less than £20,000!" "The most absurd scheme that ever entered into the head of man to conceive," shouted Mr. Alderson, the leading counsel. "No engineer in his senses would go through Chat Moss," solemnly declared Mr. Giles, the most eminent engineer brought forward by the opposition. He estimated the cost of such a project at £270,000. Stephenson did it for £28,000, but the line was an expensive one as it had so many fox covers to avoid.

All this was but a preliminary skirmish, the main battle now began. The beef-

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eating Briton was thoroughly aroused. George Stephenson was considered to be an incarnation or certainly an implement of his Satanic Majesty. The public were appealed to, and ever ready to hinder progress, they took off their tuxedo, smocks, frocks, morning coats or whatever covered their bodies, and formed phalanx against the common foe. A meeting of Manchester ministers of all denominations was convened. This meeting declared that the locomotive was "in direct opposition both to the law of God and to the most enduring interests of society." This set match to powder. The doctors declared that the air would be poisoned and birds would die of suffocation. The landowners, that the preservation of pheasants and foxes was no longer possible. Householders, that their houses would be burnt down and the air polluted by clouds of smoke. Horse-breeders, that horses would become extinct. Farmers, that oats and hay would be rendered unsaleable. Inn-

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keepers, that inns would be ruined. Passengers, that boilers would burst. Heaven knows who—" that the locomotive would prevent cows grazing, hens laying, and would cause ladies to give premature birth to children at the sight of these things moving at four and a half miles an hour ! "

Yet there was this consolation. The very, very ordinary man, the British public at large, declared that " the weight of the locomotive (six tons !) would completely prevent its moving, and that railways, even if made, could *never* be worked by steam power." Yet for ten years now, and more, the Killingworth engines were running daily !

The Stockton and Darlington line was a tremendous success ; so also was the railway between Manchester and Liverpool, yet opposition thickened rather than lessened. In 1830, the " Rocket " had attained a speed of thirty-five miles an hour, yet, in 1832, Colonel Sibthorpe (the Army now come into the picture and

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oh! how bravely), declared his hatred of these " infernal railroads," and that he " would rather meet a highwayman, or see a burglar on his premises, than an engineer! " When the Birmingham railway bill was before Parliament, Sir Astley Cooper, that most eminent of surgeons, declared: " You are entering upon an enormous undertaking of which you know nothing. Then look at the recklessness of your proceedings! You are proposing to destroy property, cutting up our estates in all directions! Why, gentlemen, if this sort of thing be permitted to go on, you will in a very few years *destroy the noblesse!* " And this, from a man who had been knighted for cutting a wen out of George IV.'s neck!

THE NATURE OF THE BEAST

All this is not only amusing, but vastly instructive—these beaters of shoe lasts on the lintel of genius. Here we have a

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deep and vivid study presented to us of popular ignorance, that universal coagulant of truth. In 1824, George Stephenson had said to his son and a companion: "Now lads, I will tell you that I think you will live to see the day when railways will come to supersede almost all other methods of conveyance in this country—when mail coaches will go by railway, and railroads will become the Great Highway for the King and all his subjects. The time is coming when it will be cheaper for a working man to travel on a railway than to walk on foot."

The victory was won in 1825, the year following this memorable prophecy; yet, in 1835, the reactionaries were still fighting a rear guard action, and we find the landed gentry sending forward their servants and luggage by rail and condemning themselves to jog along the roads in the family coach. On the Continent it was just the same, and even in 1862 the Papal Government opposed the opening of the Rome and Naples

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railway. The rear guard fought on until June, 1842, when, on a certain Monday, Her Majesty Queen Victoria made her first railway trip. It was from Windsor to London, and her coach had a crown on its roof. The reactionaries went head over heels, donned their frock coats or whatever garment appertained to their social rank, and declared the railway the greatest blessing God had ever permitted man to discover. The Marquis of Bristol, wildly excited, said that "if necessary, they might *make a tunnel beneath his very drawing-room*," and the Rev. F. Litchfield that he did not mind if a railway ran through his bedroom, "with the bedposts for a station." Ever irrational and unbalanced, very ordinary men went as mad on railways as they had been mad against them. The panic of 1844—1846 was the result. In the last-mentioned year applications were made to Parliament for powers to raise £389,000,000 for the construction of new lines.

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On the 26th of June, 1847, a year before George Stephenson died, he attended the opening of the Trent Valley Railway. Sir Robert Peel was his host and proclaimed him "the chief of our practical philosophers." Seven baronets and two or three dozen members of Parliament, all in frock coats and tall hats, did homage to the great engineer, whilst the clergy blessed the enterprise and bid all hail to the new line as "enabling them to carry on with greater facility those operations in connection with religion which were calculated to be so beneficial to the country."

I wonder what passed in George Stephenson's mind. In 1825 he was universally proclaimed mad and a danger to society; in 1847 he is proclaimed "the chief of our practical philosophers" and the saviour of society. I wonder which he objected to most—their abuse or their praise? Both, I should imagine, were largely overlooked by him, for he was a very great man, and surely those who

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abused him and praised him—very, very small—truly insignificant.

PROTEAN IGNORANCE

Protean ignorance never dies; this is the problem which confronts us. George Stephenson has only been my peg upon which I have hung this musty old skin, indeed no golden fleece, but just as magical, so that I might the better examine it; and a fine stout peg it is—all of British oak.

Stephenson was the father of the locomotive; as to this there can be no dispute, and equally can there be no doubt that the locomotive has changed the superstructure of the civilized world, yet its foundations remain permanently fixed. Matter fluctuates as the will of man unmask the material world; but the soul of man remains fixed, abiding in the solitude of his ignorance.

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Ignorance and stupidity are always with us, they are the Dioscuri of the temple of life. To change the material world is like changing our clothes, to change the spiritual world is like changing our intestines. Spiritual, I admit, is not the exact word, neither is moral nor human. To me, the spiritual is all-pervading and uninfluenced by intelligence or reason. A man who is grossly ignorant is grossly religious, for he is a worshipper of idols.

To-day we see the multitudes bending the knee to Baal, and yet we see them surrounded by misery, woe and suffering. No disease is incurable, no ill cannot be conquered. But every would-be saviour, however humble, must prepare for crucifixion, because the very multitudes they would save are in themselves their worst enemies.

Henry Herbert never dies, he was here before Adam took form from out the dust of Eden, and he will be the last man to leave this earth when the last trumpet

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sounds, and I have not the slightest doubt that he will then question the wisdom of the Almighty. He will question the wisdom of all things new, and yet, to-day, the world is groaning for novelty, for material growth means also material decay. Though very ordinary men can build middens, it is only the extraordinary man who can shift these piles of refuse—accumulations of old traditions, customs and accepted things. To me the moral of this centenary is not the power of steam, but the power of the will of man. George Stephenson triumphed over all difficulties, because he was possessed of a will to win. The stronger opposition grew the more mighty grew his will. Protean ignorance has, therefore, its virtue; it renders progress difficult to attain; it is the whetstone of genius. When we realize this, in place of wringing our hands in lamentation when Henry Herbert beats his last against our door, we open it and look at him, and laugh,

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and then close it and go on with our work—in one word, we persevere. Laughter and Perseverance, surely these two are the shield and sword of progress.

THE CONQUEST OF THE ELYSIAN FIELDS.

THE EQUATION OF POWER AND MOVEMENT

POWER and Movement, these are the foundations of civilization and the sire and dam of progress, and before the days of Watt, Fulton and Stephenson, all Anglo-Saxons, how shallow were they laid; so shallow that their social and industrial superstruction is, to-day, difficult to visualize, let alone to understand. Here is a little glimpse, and if not a very dramatic one, yet one which is apt to make us wonder at this lost world of little more than a century ago, a world all but obscured in clouds of steam.

In 1770, Adam Smith wrote (and be it remembered that for fifty years after this date the picture remains true) the following:—

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“ A broad-wheeled wagon attended by two men, and drawn by eight horses, in about six weeks' time carries and brings back between London and Edinburgh near four 'ton weight of goods. Upon two hundred tons of goods, therefore, carried by the cheapest land-carriage from London to Edinburgh, there must be charged the maintenance of a hundred men for three weeks, and both the maintenance, and, what is nearly equal to the maintenance, the wear and tear of four hundred horses, as well as of fifty great wagons.”

To-day, when the trans-Siberian railway is in working order, a man can travel in the same time, with four tons of baggage if he wishes, from London to Tokio and back. Edinburgh is four hundred miles from London, and Tokio is some eight thousand miles from this same city ; such has been the expansion of movement and the contraction of space, and to-morrow aircraft may reduce the time taken to a fortnight.

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The fire of Prometheus is as a rush-light compared to the volcano of steam which, like all great world forces, is a mixture of Pandora and her box ; for it has given us beauty and wealth, and also ugliness and starvation. It revived the world, bled white during the Napoleonic wars, and, in place of conquering the world as the great Corsican attempted, it recreated it.

When men began to move by steam power, Titans strode this earth. In peace time we see science advancing as it had never advanced before, industry growing beyond belief or imagination. Cities spring up in the night, such as Chicago, for whilst, in 1830, its population numbered a hundred souls, to-day it holds nearly three millions. Nations grew and doubled, trebled and quadrupled their populations, and the wealth of Cræsus is to-day but the bank balance of Henry Ford. Yet out of all this prosperity, created by steam-power, arose the Great War of 1914-1918, which, in its four years of frenzy, was to show a surfeited

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civilization the destructive power of steam.

What do we see during this last period of roaring turmoil? A curious picture. The railway and the steam-ship, which, during days of peace, increased movement out of all belief, during war end by impeding it. Like great funnels, we see the railways, pouring forth cataracts of men, veritable human inundations, and then we see that, though it is easy to move masses by rail, once the rail is left behind, it is next to impossible to supply these masses by road, or to move them in face of gun and machine gun. The war becomes a war of trenches, not a moving war, but a stationary affair—men look at each other and sometimes shoot.

As peace begets war, power and movement are the foundation of the second, just as they are of the first. On the battlefield or in the workshop, power is useless without movement. It is no good setting up a boot factory, unless you can get the boots on to the feet of the people, and in

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war it is no good piling up bayonets, unless you can get them into the intestines of your enemy. Thus, it happened that, before the war was three months old, though each side possessed much power, power in itself was useless, for it could not be moved. The remaining four years of the war were spent in solving the equation of power and movement.

This problem was partially solved by the tank, which possessed both power and movement. And from the armies which used these machines, and there were never very many of them, little streamlets of men trickled forward out of these great stagnant human pools, and the war was won.

THE RIDDLE OF THE GORDIAN KNOT

What is our problem to-day? It is again the problem of power and movement; not a new problem, but a very old

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problem, in fact the eternal problem dressed up in a new frock. Our problem is to revive our old industries, so far as they can be revived, and to establish new ones, for industries, like the human beings who create them, grow old, come on the pension list and die. Our problem is, as it was during the war, to shift the population, to demobilize our great army of unemployed, and to cause it to trickle from our over-populated little island into our under-populated Dominions and Colonies. Lastly, our problem is to secure ourselves against another war.

To-day, we find ourselves in a veritable labyrinth of difficulties, but there must be a way out, possibly several, for otherwise we could not be standing in its centre. We have got into it, so we can get out of it, as we have of many a former maze; but how?

It is here that I think the spirit of George Stephenson can help us, and it is for this reason that I have taken up so much of this little book with this great

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man's name and work, and with the difficulties he faced and, undaunted, conquered. His motto was " Perseverance "; let it be ours. He did not talk over much, but he took his coat off and got to work. He worked single-handed and was obstructed at every turn. The whole country was against him, yet he conquered, and, more to him than to any other man a century ago, it seems to me, were the problems, which then faced England, solved, and they are the problems which face England now.

As it may be said, and with some truth, in fact a great deal of truth, that the railway made the war, since it made the peace which preceded the war, so with equal truth may it be said that the petrol engine, encased in a tank, by making peace possible, may now make peace profitable, even if in doing so it begets the germs of another war. In other words, as the war was so largely won by the tank, so must the peace which has followed it be largely

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won by the caterpillar tractor, or roadless vehicle.

Henry Herbert will vote me to Bedlam, but this is the most encouraging fact of all, for every new idea must start by being in a minority of one, such as that of George Stephenson's against the world. The stronger the opposition the better the idea, may not be a law of Nature, yet it is a pretty sound rule, and one with few exceptions. If we persevere and laugh, the caterpillar tractor will win the peace, and to paraphrase the words of George Stephenson, I will, in my turn, make a prophecy:

“ Now lads, I venture to tell you that I think you will live to see the day when tracked vehicles will supersede almost all other methods of conveyance in roadless countries; when armies will be moved across country and roadless traction will become the chief means of commercial movement in all undeveloped lands. The time is coming when it will be cheaper for a farmer or soldier to use a

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tracked machine than to travel by rail."

As it took Mahomet three years to collect thirteen followers, I shall not be downcast if I collect no greater, a number out of the readers of this book, because perseverance was the motto of Mahomet as well as of Stephenson, and as perseverance won them their battles, may it win me mine.

Many will consider my prophecy ridiculous, and a multitude of Henry Herberts will foam at the mouth. Protean ignorance is against me—a resilient Everest of oiled rubber. A hundred years ago it was boisterously hostile to novelty, to-day it is somnolently apathetic, and, in this latter mood, it is almost more overpowering than in the former. Nevertheless, let us smile, let us take off our coats and climb this glutinous mountain, for the Elysian fields lie beyond.

A few years ago we were told that, once the war was won, this little island

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of ours was going to be fit for heroes to live in, as if any country ever had been or could be an Eldorado after a great war ! To-day, we have well over a million unemployed men and women in this country, and I have no doubt there are many heroes and heroines amongst them ; certainly the conditions demand an heroic race to win through.

Our present difficulties all boil down to one recognizable sediment. Great Britain is over-populated. Before the war we were over-populated, and to-day we are still more so, and to-morrow matters are likely to be worse.¹ There are three solutions to this problem. Either we must stop breeding, or we must create new home industries and so absorb our surplus population, or we must transport it to less thickly populated areas overseas.

Six hundred and odd politicians in

¹ In 1913, 700,000 emigrated from this country ; in 1923, only 463,000 left.

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Westminster, some in black ties and others in red, chatter like a wilderness of monkeys, whilst those who were proclaimed heroes may consider themselves lucky if they are allowed to stand in the gutter and sell bootlaces; and in this chatter the problem is drowned, only to bob up again, between each breath.

We are told that the Government's determination is "not to tolerate propaganda for birth control in clinics and maternity centres supported by public funds." This settles the first solution, at least the Government does not believe in it. Recently, because the coal mining industry was unable to pay its way, it is now subsidized, and many new industries are left unprotected, so the second solution joins the first. As regards the third solution, very little has been done outside private effort, because the problem has been tackled from the wrong end. Attempts are persistently being made to shift the unemployed; who wants them?

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In place attempts should be made to shift the employed, but this question I will examine a little later on.

The point I want the reader, however, to realize^{*} is that, as the riddle of the Gordian knot was *not* solved by cutting it, so the problem of over-population will not be solved by the dole. Cutting and doling can be done by any fool with his coat on, they are too easy ; for the problem which faces us demands that we take our coats off and get to work, in place of turning our less fortunate fellow citizens into unemployable vagrants.

THE PROBLEM OF UNEMPLOYMENT

Birth control I rule out of discussion, and though I am of opinion that it might well be made compulsory amongst politicians, my solution demands not a restriction, but a vast increase in the birth rate.

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The invention of the locomotive and steamship upset all birth rate calculations.¹ During the last century it has been reckoned that twenty-eight million people left Europe by sea, four millions during the first half and twenty-four millions during the second, the period of railway and steamship development. Out of these twenty-eight million emigrants, twenty-two millions went to the United States, the population of which was five and a quarter millions in the year 1800, seventy-six millions in 1900, and is about one hundred and ten millions to-day, and quite possibly, before the present century is out, this figure will be doubled.

In the United Kingdom we see, if not so great, as startling an increase, considering the smallness of the country. In 1801, the population numbered about sixteen millions, and to-day, excluding Ireland, it numbers about forty-four

¹ In 1750, before the industrial revolution set in, the population of the United Kingdom was 6,517,000.

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millions, which is probably four or five millions more than the industry of the country can economically support, as unemployment and the low standard of living, not only now but before the war, testify to.

Let us remember always what has created the great civilizations of the past, empires and kingdoms, prosperous lands and great cities. It is movement and the means of movement. First man placed a bundle on his wife's head and gave her a kick, then he tamed the ox and beat it with a stick, thus civilization became possible. At length, he invented the wheel and the sail, and, by means of these inventions, mankind crept out of primeval darkness into the dawn of history. In 1809 Fulton invented the steamship, and in 1814 George Stephenson built his first locomotive. It is, as I have already said, these inventions which have created not only such immense cities as modern London and New York, but which have shifted millions of men, women and

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children from one part of the globe to the other. Why did they shift them, this is the question? Because the steamship and the railway enabled them to tap sources of wealth which did not exist in their own countries; for without prospects of wealth there would be little or no movement.

Today, we possess an Empire of over fourteen million square miles in area, of which three-quarters is sparsely inhabited. In Canada we find nine million two hundred thousand people; in Australia five million eight hundred thousand; in South Africa eight millions, and in New Zealand only one million two hundred thousand; yet New Zealand is as big as the British Isles.

Without considering our immense Colonial possessions, the potential wealth of the Dominions alone should eventually be sufficient to support certainly one if not two hundred millions of Englishmen. On the one hand we have room for at least a hundred millions, and on the other we have a surplus of some five millions.

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The redistribution of this surplus should not prove an insuperable problem, and even if it cost us twenty pounds a head to arrive at a solution, it would be cheap when compared to spending forty-six millions a year on doles and poor rates, which, far from solving the problem of unemployment, only accentuate it.¹

In former times, the danger inherent in immigrations was the hostility of the tribes in occupation of the new lands—the problem was a military one. To-day, the difficulty is not military, but financial. To-day, it is no longer bows and arrows which restrict immigration, but money. To-day, it is not profitable to tackle a land owner with a rifle, and nearly all land worth owning is owned; instead the settler must buy the land, or be sufficiently skilled to dispose of his labour at a profit.

Our present-day unemployed have no

¹ "Schemes to the value of approximately £466,000,000 undertaken in connection with the relief of unemployment have, or are being assisted by the Exchequer." — *Whitaker's Almanack*.

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money and little skill. To send such people to the Dominions is no true solution of the unemployment problem, for it only shifts the unemployed from one place to another, and this does not solve the problem. In 1914, Germany attempted to gain the French Colonies, not because she wanted to shift to them the vagrants of Berlin and Hamburg; but, because the possession of these Colonies would have enabled thousands of well-to-do Germans, the small capitalists and skilled workers of the middle classes, to enrich themselves without loss of nationality. Incidentally, as these people emigrated, room would be made in Germany for the under-dog. Competition would have decreased with a decrease in not the unemployed, but in the employed population. Wages would have increased in proportion and, by degrees, the greater percentage of the under-dogs, through increased wealth, would have raised themselves into the middle class as small capitalists.

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To-day, there is no necessity for us to covet the territories of other nations. We possess ten million square miles of sparsely-populated land in which Englishmen will not be lost to the Empire. To-day, we see this problem mentioned in every paper, but writers will persist in thinking in terms of the *unemployed*. It is the *employed* we must shift, not only because at home room will thus be made for the unemployed,¹ but because it is the skilled man or the small capitalist who can thrive in the Dominions and Colonies and the unemployed normally cannot.

¹ It may be considered by some that this will mean that we in England shall be left with the unworkable dregs of society. Such a view is a gross libel on the bulk of the unemployed. Before the War, seventy per cent. of the recruits for the army enlisted because they were unemployed. During the War these men were universally proclaimed heroes, and such they were. I can personally testify, after twenty-seven years of service in the army, that less than five per cent. of the men in any unit of regular soldiers would make undesirable citizens if vocational training were fully established. If, however, men are kept unemployed for years they will eventually become unemployable.

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THE PROBLEM OF POWER

To move we must not only possess the means of movement, but the will to move ; for, without this will, all the means in the world are but scrap iron and dead timber. The men who first tamed the camel and the horse must have had ideas in their heads—visions which impelled them to do what they did. It may have been sympathy for his wife as she carried his load which induced men to jump on a horse's back, but much more likely was it her low carrying power and possibly also to get away from her restless tongue.

In ninety-nine cases out of a hundred, the will to move is stimulated by material gain. To possess something easily, cheaply, and, if possible, for nothing, is the urge of both commerce and robbery, twins of Fear and Greed, forces of vice as well as of virtue, the forces of the growth of the human world, and forces not to be set aside lightly.

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The nomadic hordes surged out of Asia in the search after food. It was the desire to fill their stomachs which moved them. They trickled over Europe until they met the sea, and then, as years passed by, they conquered the ocean and swept into the New World. What will happen when the Americans begin to swarm, it is difficult to say. Will they once again set out to pursue the setting sun? Who knows?

So also with the wars of the world, as with these slow but steady human inundations, it has nearly always been a material goal, however shadowy in form, which has provided the urge. Security, what is this? The shield of Prosperity and Liberty—a desert, a river, a range of mountains, or a feeble neighbour; in one word, a secure frontier to shield a people, so that they may enjoy the fruits of peace; this has been the urge of war.

Then, from war, which so often is but robbery on a national scale, to turn to barter, amicable warfare; and from

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barter to turn to commerce, amicable war on a national scale, what has been the urge? A gold field, oil wells, land where corn will grow or cattle will breed; in one word, the possibilities of wealth, which is the loadstone of movement.

The potential wealth of the Empire is stupendous, and potential wealth is power asleep, power awaiting to be roused from its slumbers, the power of coal, of oil, and water, of the air and the sun's rays, of the tides and of the atoms themselves. The whole world is a gigantic battery of power, and our Empire covers a quarter of this world, and all that is needed is to detonate it, and it can only be detonated by the will of man.

The Romans conquered by building roads, the modern world, by building railways. Yet both are but a one-dimensional means of movement, and, in type, so near related, that even to-day the gauge of our railway lines is the gauge of the Roman chariots. Suppose now that these roads and railways could suddenly

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expand laterally, so that from a few feet broad they could expand to a few yards in breadth, then to hundreds of yards, miles, and hundreds of miles, until it is as easy to move over the surface of the earth as over the surface of the sea. A second dimension would be given to movement; a new world would be born, since a stupendous sleeping power would be awakened. Stephenson improved the chariot. In place of taking three weeks to go from London to Edinburgh we can now travel there in eight hours. He conquered Time rather than Space. The storming of the Bastions of Space, this is the problem of the future, and one of our engines of conquest is the cross-country machine.

PROBLEMS OF MOVEMENT

Economic movement may be divided into five great categories, namely, move-

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ment by air, by water, by rail, by road and by pack. Each may be divided into two sub-categories. Thus, air movement by transport lighter and heavier than air; water movement into sea transport and inland water transport; railway movement into broad and narrow-gauge lines; road movement into transport by wagon and lorry, and pack movement into human and animal portorage or carriage.

I do not here intend to examine movement by air and water, and, as regards the other three categories, I will limit my examination to their use in undeveloped countries, more particularly within the Empire, and I will start with the railway.

The Railway. The country through which a railway is built may be divided into three economic areas:—

(i) A belt about eighty miles in width, through the centre of which the railway runs.

(ii) Two belts, each about twenty miles wide, extending on the flanks of the central belt.

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(iii) The whole of the country concerned, excluding the above three belts.

Whether the prosperity of the country is based on minerals, cattle, or cereals, the first belt is normally prosperous, the second two less prosperous, and the remainder of the country unremunerative. To bring the whole country up to the prosperity of the first belt demands a railway every eighty miles.

Obviously, in an undeveloped country, to build railways every eighty miles is prohibitively costly, but as nearly every nation in the world is prepared to spend millions of pounds on the construction and maintenance of railways and rolling stock, and often with little reference to the law of supply and demand, it is advisable, I think, briefly to examine the question of cost.

The cost of a railway decreases as the load increases; the load must, consequently, be sufficient to pay for the capital expenditure entailed in constructing the line and also its maintenance.

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The cost of the Nigerian railways was £11,000 per open mile; the estimated cost of new construction in the Gold Coast lies between £13,000 and £17,000 per mile. For railways costing as much as these, and the figures are not abnormally high, to pay, the country they traverse must not only be fertile or rich in minerals, but thickly inhabited.

I have already examined the question of population in the Dominions, all of which are to-day sparsely inhabited, so I will now turn to another area, namely, British Tropical Africa, a potentially immensely rich country covering some two and a half million square miles and occupied by forty million inhabitants. To run railways through this country would be similar to running railways through Great Britain less its present elaborate system of roads¹ and with a population numbering about two and a quarter millions. In such conditions railways

¹ There are 178,000 miles of road in Great Britain.

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would most certainly not pay, and would only begin to do so when road feeders had been built and the country had become thickly populated.

The Road. As economically the railway is length with little breadth, in undeveloped countries it can only be looked upon as an artery, depending for its freight on the roads and tracks which converge on it. If these roads and tracks be few in number, generally speaking, freights will be insignificant, and the railway, in place of fostering wealth, will swallow it up or stifle it. The railway must, therefore, be skirted by a network of roads.

The cheapest form of road is a rough cart track, and where the country consists of grass land and the rainfall is low, as in South Africa, extensive use can be made of bullock wagons for purposes of transportation. The bullock wagon has reached, however, the zenith of its evolution, and is by no means suited for countries where grazing is difficult. If

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fodder has to be carried in bulk, it at once becomes an uneconomical means of movement.

If the country to be traversed is unsuited to this means of transport, we are left with the lorry, and though light box-cars, such as Ford vans, can use rough tracks and frequently move across country, the load carried is so small, that, unless it is of a particularly valuable nature, or distance is short, the cost of carriage becomes prohibitive. We are left, therefore, with the heavy lorry, varying from three to six tons burden.

These vehicles obviously demand macadamized roads, which not only are extremely expensive to build, but in a sparsely inhabited country prohibitively expensive to maintain. Here in England, we spend yearly £50,000,000 and more on road repair.² In Jamaica, £1,000,000 is spent on the maintenance of lorry

¹ In 1914-1915 the maintenance of roads cost £19,000,000, in 1921-1922 this sum had risen to £45,500,000.

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roads. In both countries this means that each inhabitant has to pay slightly more than £1 a year to meet the road repair bill. In tropical countries, where torrential rains fall and vegetation luxuriates, the macadamized road is out of the question, so also is it in desert land where the sand is apt to silt over the roadways.

If the road will not suit the vehicle, the vehicle must be made to suit the road. Here again the difficulty is economically almost insuperable. Balloon tyres, the use of light trailers and of multi-wheel vehicles will partially overcome the difficulty; but rubber rapidly deteriorates in tropical countries, and though a vehicle, such as the Renault six twin-wheel car, has carried out some wonderful performances in the Sahara and elsewhere, the maintenance of twelve balloon tyres practically rules it out of court in most undeveloped countries.

If the bullock wagon is restricted to certain areas, and if the lorry demands a

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road which is prohibitively expensive, the only remaining sources of transport which can feed the railway are the pack animal and the human porter.

The Pack Animal. In examining this last system of transport, I will begin with the human pack-animal, the native porter. Not only is this means of carriage the most primitive of all, which renders it somewhat of an anachronism in the twentieth century, but it is extravagant in the extreme. Economically it is unsound, since the human pack-animal stands in the way of the development of his country. In the first place his productive work is lost, and in the second, the load carried is so small as to offer little encouragement to the producer. Last, and by no means least, unlike the railway, as the amount increases, so does the cost per ton mile increase with it.

On a large scale the system is impossible, and the substitution of pack animals for porters is but little less uneconomical, except in mountainous

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countries and desert lands, and in the latter, it would seem that the reign of the camel is approaching its end, since in most places where a camel can go a car can follow.

TWO-DIMENSIONAL MOVEMENT

The above, I admit, is a very brief summary of an immense and complex subject, namely, the bridging of the gap which exists between the producer and the arterial railway, or the producer and his market, if it be a distant one. Ruling out pack and porter as being too uneconomical to be used on a large scale, we are left with the wagon, the lorry and the light railway. All these three means can cover great distances, but they do not solve the problem, because the solution does not only lie in power to traverse distance, but in ability to cover the largest area in the shortest time.

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The difficulty so far has been that the wheel demands a road and destroys a road, and that, whilst it is easy, though frequently very costly, to make a road which will suit a wheel, it is most difficult to make a wheel which will not damage a road; for failing a cheap and simple form of Pedrail wheel, a system of multi-wheels has to be resorted to, and this system leads directly to the tracked machine, which not only can dispense with roads, but, what is equally important, can make its own track, just as the feet of a man form a path by frequently crossing the same piece of ground.

This is not the place to examine in detail the technicalities of roadless vehicles; but to-day there are two main types of these vehicles; an all-tracked machine of the tank type, and a half-tracked machine which has wheels in front and tracks in rear. The first is more suitable for heavy loads, and the second for light.

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In the manufacture of these vehicles three main problems must be solved:

(1) The vehicle must be able to use roads without damaging them; nor must it damage the surface of the ground it travels over.

(2) It must be able to move across country without damaging itself.

(3) The cost per ton-mile must be equal or lower than that of existing vehicles.

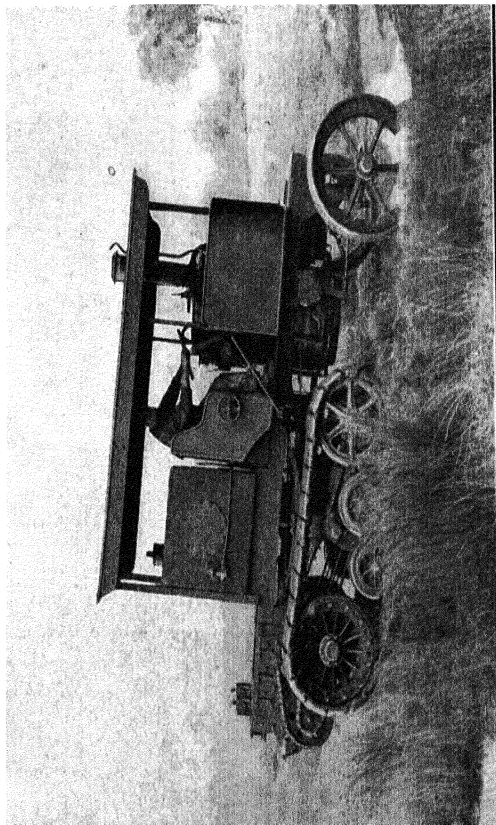
It may seem a paradox to lay down that the first requirement of a roadless vehicle is that it can negotiate roads, but, in fact, it is not so; for it stands to reason that, when prepared tracks do exist, it is only wasting time and energy to travel across country. Further, if the tracks of the vehicle are so constructed that they do not damage roads, they will not damage the surface of the ground, and, consequently, by continually travelling over the same ground, they will compact and consolidate its surface and rapidly form a road of their own which will

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require no metalling. This advantage is one of the great secrets of its success.

As movement across country entails traversing rough ground, the tracks of a roadless vehicle must permit of the absorption of obstacles. This absorption is attained by springing the tracks. In an unsprung machine, obstacles are either crushed into the ground or the vehicle has to lift itself over them. In both cases the result is injury to the machine, and loss of power and discomfort.

It stands to reason that the vehicle must be durable, simple and easy to maintain; also that the ton-mile cost must be low. As regards this latter requirement, experimental machines have so far proved that this is a possibility. A one-ton roadless Guy Lorry recently travelled from London to Aldershot, and its ton mileage was fifty-two to the gallon. It has also been worked out that the cost per ton-mile of the Sentinel tractor, "including overhead charges, depreciation, interest on capital and all running charges, and



SENTINEL TRACTOR

CONQUEST OF ELYSIAN FIELDS

allowing for a 20-tons net load for a reasonable number of working days in the year," will be slightly under twopence per ton-mile.

In the future, the types of roadless vehicles are likely to be great as the surface of the ground differs in various countries; also fuels of all kinds are likely to be burnt, such as petrol, oil and coal, and in tropical countries, where these fuels are scarce or expensive, producer gas is almost certain to become the main motive power.

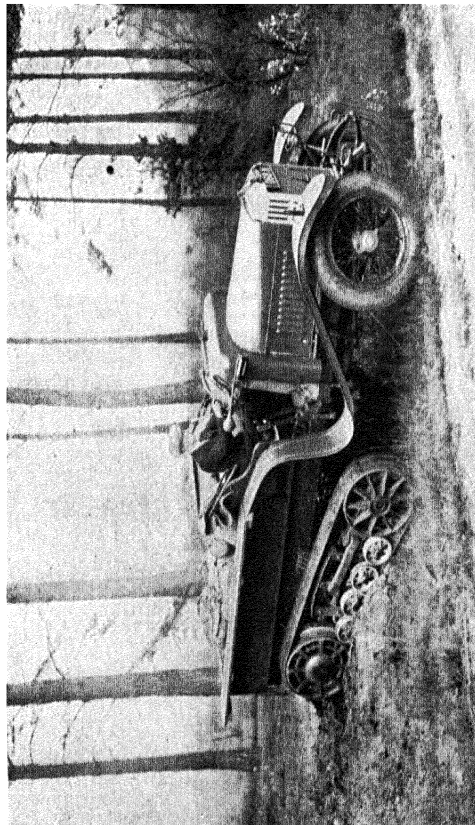
The most remarkable achievement as yet carried out by roadless vehicles is undoubtedly the crossing of the Sahara from Touggourt to Timbuctoo, during the winter of 1922-1923, by Citroën motor-cars fitted with half tracks invented by Monsieur Kégresse. The distance travelled was three thousand six hundred kilometres, and the time taken was twenty days, that is on an average one hundred and twelve miles a day. All machines returned safely, and the total journey

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there and back was over seven thousand kilometres.

The nature of the country crossed was by no means uniform, for it was sandy, rocky, mountainous and, in the neighbourhood of the river Niger, covered with tropical vegetation. To build a railway from Touggourt to Timbuctoo would cost, at the lowest reckoning, a thousand millions of francs—possibly much more; this alone accentuates the importance of the achievement and its interest to us, for the Empire contains thousands of square miles of roadless country.

I fully realize that, though the roadless vehicle can replace the motor-car, it cannot replace the railway, if the railway is an efficient one. This is, however, not the problem. The problem is, first to bridge the gap between the producer and the railway, and secondly to create in undeveloped countries sufficient wealth to enable more railways to be built. Co-operation with existing railways, this is what must be aimed at.



CROSSLEY-KEGRESE CAR

CONQUEST OF ELYSIAN FIELDS

For purposes of illustration, I will take British East Africa as an example. A railway runs from Mombasa via Nairobi to the Great Lakes. Forty miles on each side of this railway, generally speaking, is commercially remunerative. This is the first belt I mentioned above, the second two belts are productively a gamble for any but capitalist pioneers, and the remainder of the country is but the playground of rich colonists who can afford to speculate on likely railway extensions in the future, or else of simple fools.

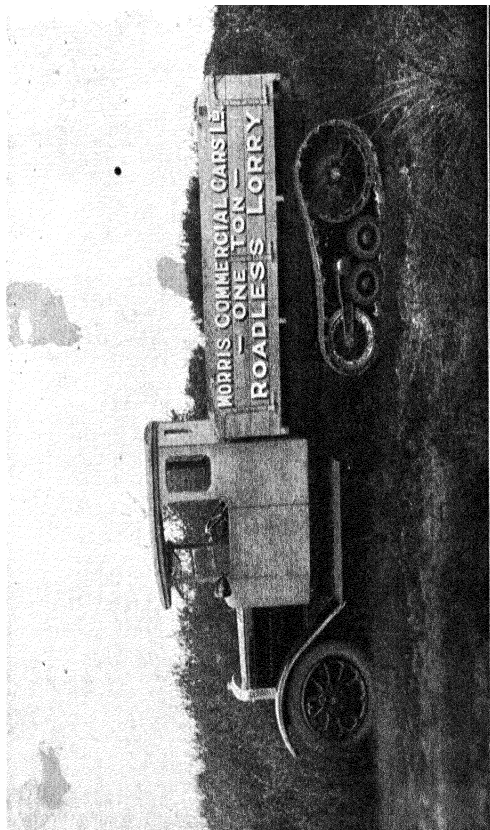
I will now suppose that a reliable roadless vehicle exists which can transport across country five or ten tons of produce. What do we see? We see the first belt extending from forty miles on each side of the railway to a hundred miles, and the second two belts being pushed out, in vastly improved circumstances, fifty to a hundred miles on each side of the new central belt. In fact, we have more than doubled the central belt and trebled the belts adjoining it, and, in doing so, have

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more than doubled the commercial prosperity of the country.

What now is our next step in the evolution of economic movement? It is, out of the wealth resulting, to extend from our main Mombasa-Nairobi railway, metre gauge lines in herringbone fashion up to the confines of the new central belt, and at the termini of these to build receiving depôts. In place of metre gauge lines, huge roadless machines, carrying and hauling from a hundred tons upwards, will in the end, I think, prove more economical. Once these depôts have been established, the smaller machines belonging to the farms and stations can bring produce to them and dump it. Thus, by degrees, will the central railway be fed by a prosperous area some four to five hundred miles in width.

To take another example. A transportation problem which faces every farmer is that of rapid door-to-door delivery. To-day, especially in such



MORRIS ONE-TON LORRY

CONQUEST OF ELYSIAN FIELDS

countries as Canada, what do we see? We see chain-tracked machines used for agricultural work, but we seldom see movement of the produce grown carried out save by horse-drawn vehicles, which can negotiate cultivated land if it be fairly dry.¹ Two horses cannot pull much more than a ton over a heavy field to the farm itself. At the farm, which may be fifty miles from a railway, the produce has either to be transported by cart to the station, which may take three days and two to return, or loaded into a lorry which, unless the roads are good, will take one day each way. The loss of time is considerable, and the roadless vehicle would appear to be the only practical solution. It can be loaded at the extremity of a field in any weather and condition of ground, and moved direct to the railway either by road or across country at a normal lorry

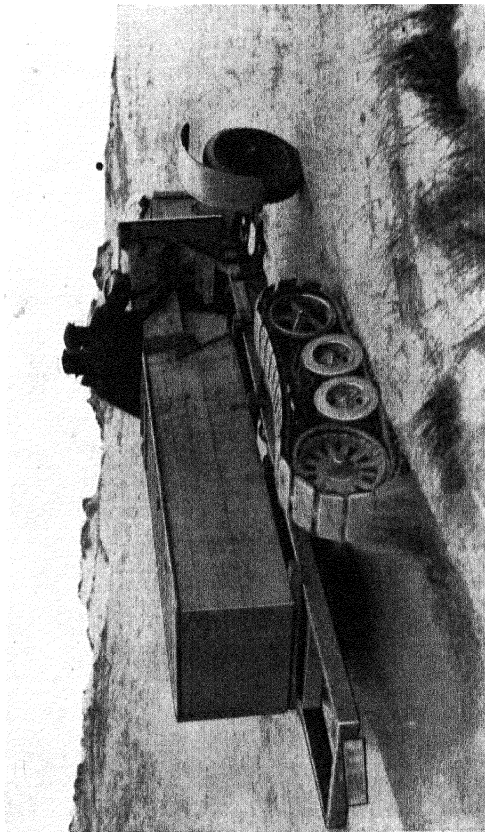
¹ In Canada, snow offers a serious difficulty to movement by wagon or car during the winter months; there should be no great difficulty in producing a roadless vehicle which will cross snow almost as easily as grass land.

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speed, and carrying from three to ten tons according to size. Delivery is from door to door, and the only limitation as to load would appear to be the factor of safety of the bridges which may have to be crossed.

In waterless, as well as roadless areas, such as exist in Australia, wagons and lorries are frequently useless, and the roadless vehicle is again the solution, for it does not require a road to move along, or a well at which to seek refreshment. It carries its own roadway and its own water supply, and, if necessary, water for man and beast in districts where water is scarce.

In mining countries, such as Chili and South Africa, and in oil-producing countries, such as Mexico and Persia, the need for a weight-carrying, roadless vehicle is much felt, and in these countries, where again roads are few and bad, and water frequently scarcer, it would prove as useful as in agricultural lands.



VULCAN TWO-TON LORRY

CONQUEST OF ELYSIAN FIELDS

THE ELYSIAN FIELDS

To conquer the Elysian Fields we must establish new industries at home, we must move our surplus population to the lands which are underpopulated, and we must be prepared to secure our Empire against foreign aggression. All these problems can the roadless vehicle help us to solve.

First, the vehicle itself is a new type of machine which will demand an industry of its own. Twenty-five years ago, as many of us remember, it was a rarity to see a motor-car; yet there were men who, even then, could see them in legions, and one of these men was Mr. (now Earl) Balfour. "In the House of Commons on Thursday, May 17, 1900, Mr. Balfour said he sometimes dreamed—perhaps it was only a dream—that in addition to railways and tramways, we might see great highways constructed for rapid motor traffic, and confined to motor traffic, which

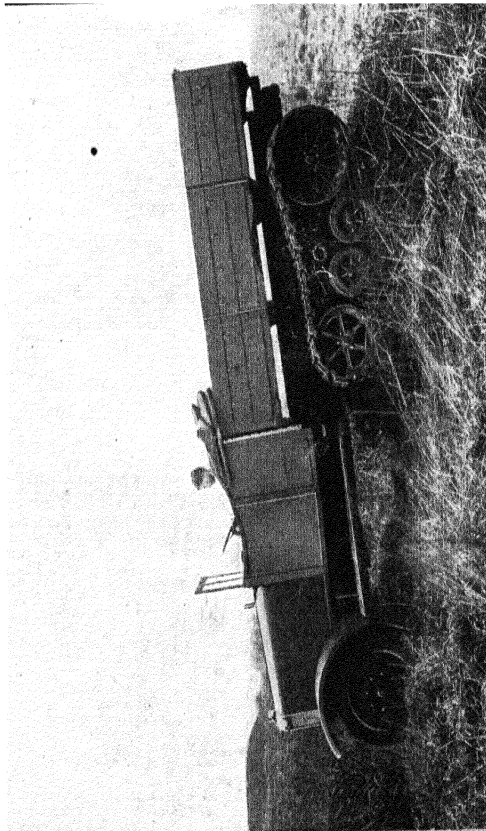
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would have the immense advantage, if it could be practicable, of taking the workman from door to door, which no tramcar and no railway could do. Is it possible for Mr. Balfour's dream to be realized? "—*Pall Mall Gazette*.

To-day, this question is apt to make us smile, seeing that the motor-car industry is one of the largest and richest in the world; that in 1924 there were half a million cars in this country and nearly fourteen millions in the United States,¹ and that hundreds of millions of pounds have been spent on motor roads.

Surely then, if I be right as regards the powers of the roadless vehicle, its future should be as great as that of the motor-car, possibly greater, seeing that most of the world is still in a roadless condition. Surely, here is employment for many men, and a source of wealth which can only be guessed at in thousands of millions of pounds.

¹ In 1924 there was one car to every eight people in the U.S.A., and one to every seventy-four in Great Britain.



GUY TWO-AND-A-HALF-TON LORRY

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CONQUEST OF ELYSIAN FIELDS

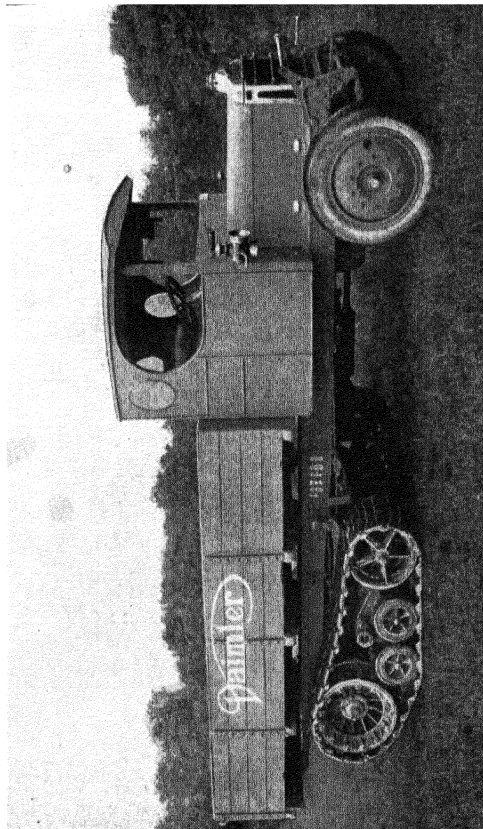
And this machine will not only create industrial wealth, but agricultural prosperity, for it will enable the farmer to settle in lands which to-day are but wilderness and waste. The old means will continue, but will be pushed more and more into the beyond. The porter will bring in his small load and so will the pack animal. These loads will be collected and loaded on small roadless machines which will convey them to the depôts from which the giant machines work backward and forward to the railway, which will carry its hundreds of thousands of tons down to the sea. We shall see less porters, less pack animals and less wagons, but more railways and more ships, and these demand men to work them. The waste lands will become fertile; townships will spring up; industries will be created, and the energy of millions of men and women will be profitably expended.

Now follows a curious sequent. If, commercially, we want to expand the Empire, strategically we want to contract

PEGASUS

it. Our object is not to maintain an immense army to pursue a course of foreign wars, but to maintain law and order throughout the Empire and safeguard its existence. The fewer men we employ the less will the army cost, and, be it remembered, military expenditure during peace time is unremunerative.

To contract the Empire is not to abandon large tracts of country, this is to cut the Gordian knot in place of unravelling it; but, instead, to move over it quicker than we can to-day. What we want to contract is time and not space, the time taken in moving over ground and particularly over roadless country. The roadless vehicle will help us to solve this problem. A battalion may march a hundred miles in a week, but if carried in roadless vehicles this distance can be multiplied by seven; and what is even more important, for long periods a line of communication can be dispensed with, because the battalion can carry supplies with it for several weeks.



DAIMLER THREE-TON LORRY

[Face p. 90

CONQUEST OF ELYSIAN FIELDS

The main strategical importance of the roadless vehicle lies, however, in the fact that it will, by degrees, fill the Dominions and Colonies with virile men. Australia with a population of twenty-five millions has little to fear from Asiatic races; with fifty millions—nothing. All these changes and many others will be discovered in an Empire recreated by a little iron, a little thought, and much perseverance.

THE WINGS OF PEGASUS

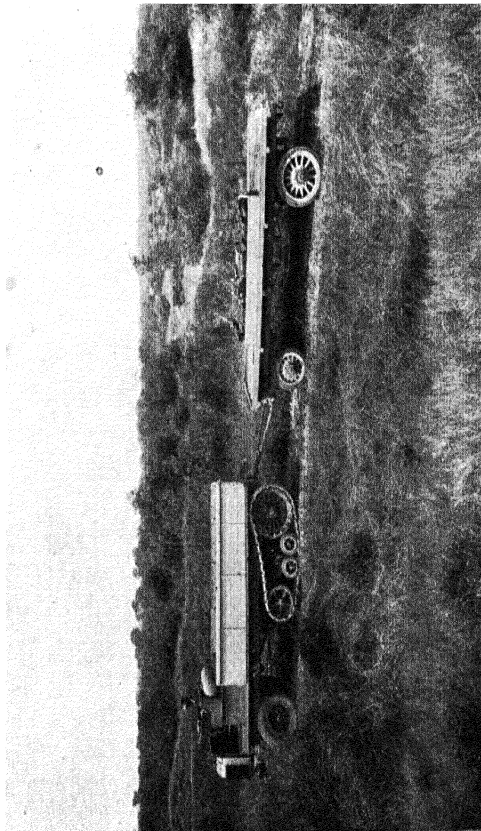
The wings of Pegasus are the wings of imagination—that telescope of the mind which magnifies the glimpses of the future; and, once we have focussed these glimpses, we must bring them down to earth, and chart out their anatomy, so that we and others can set to work.

Rudyard Kipling mounted Pegasus when he said: “When a nation is lost, the underlying cause of the collapse is always that she cannot handle her trans-

PEGASUS

port. Everything in life, from marriage to manslaughter, turns on the speed and cost at which men, things and thoughts can be shifted from one place to another. If you can tie up a nation's transport, you can take her off your books."

Shifting of thought, this is our first need, for the Great War destroyed an epoch, yet we still hark back to this epoch. A new world requires new ideas, and in the first half of this little book I have shown how ideas, a hundred years ago, were throttled by the protean stupidity and ignorance of man. To-day, these vices continue, but in their senile forms of apathy and indolence. Every government is faced by trade depression, unemployment and the cost of security, yet each in turn, whether Liberal, Conservative or Labour, turns from these problems and deflates itself on some patent shibboleth—protection, free trade, capital levy, etc., etc., until it is pushed out of office by a blind, but aggravated country.



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The crucial problem to-day is movement in all its forms. If to-morrow you can move twice the speed you can to-day, you will have twice the time at your disposal to work in. It is not gold standards and other such humbug which produce wealth, it is work; and if, to-morrow, you have twice as much time to work in as you have to-day, your existing wealth will be doubled.

This is the problem which George Stephenson saw quite clearly, and solved within the limits of the conditions he worked in. He gave the world a one-dimensional movement of a superiority never dreamt of before his day, and this superiority recreated the civilized world. To-day, we can expand this movement to cover two dimensions and recreate the world again. One day it will be done, because the world is a roadless planet, but for us, as an Empire, it may be done too late. No government minds spending millions of pounds on some pet hobby—doles, pensions, cruisers, naval bases,

PEGASUS

worn-out coal pits, etc., etc., but no government so far has spent sixpence on roadless vehicles. A hundred thousand pounds or so judiciously expended on research and experiment might well result in the production of half a dozen efficient types of cross-country machines. Has no government the intelligence to understand this, or the imagination to see what it may lead to?

Pegasus without his wings is a very ordinary animal; with them—most extraordinary, for he flew to Olympus, a land fit for heroes to live in, and not one in which no one but a hero can survive. Why not follow his example, why not look around us and discover the pivot of our difficulties, and then, why not from the mountain top of reason gaze into the future and conjure up the images of things to be? Then, let us descend into those tumultuous and dismal valleys below, and to Laughter and Perseverance add Wisdom. With this trinity to lighten our way, surely will our way grow straight

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and broad, and the clouds which are gathering around us, disperse; and surely then shall we discover those Fortunate Islands which to-day we are so blindly seeking.

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